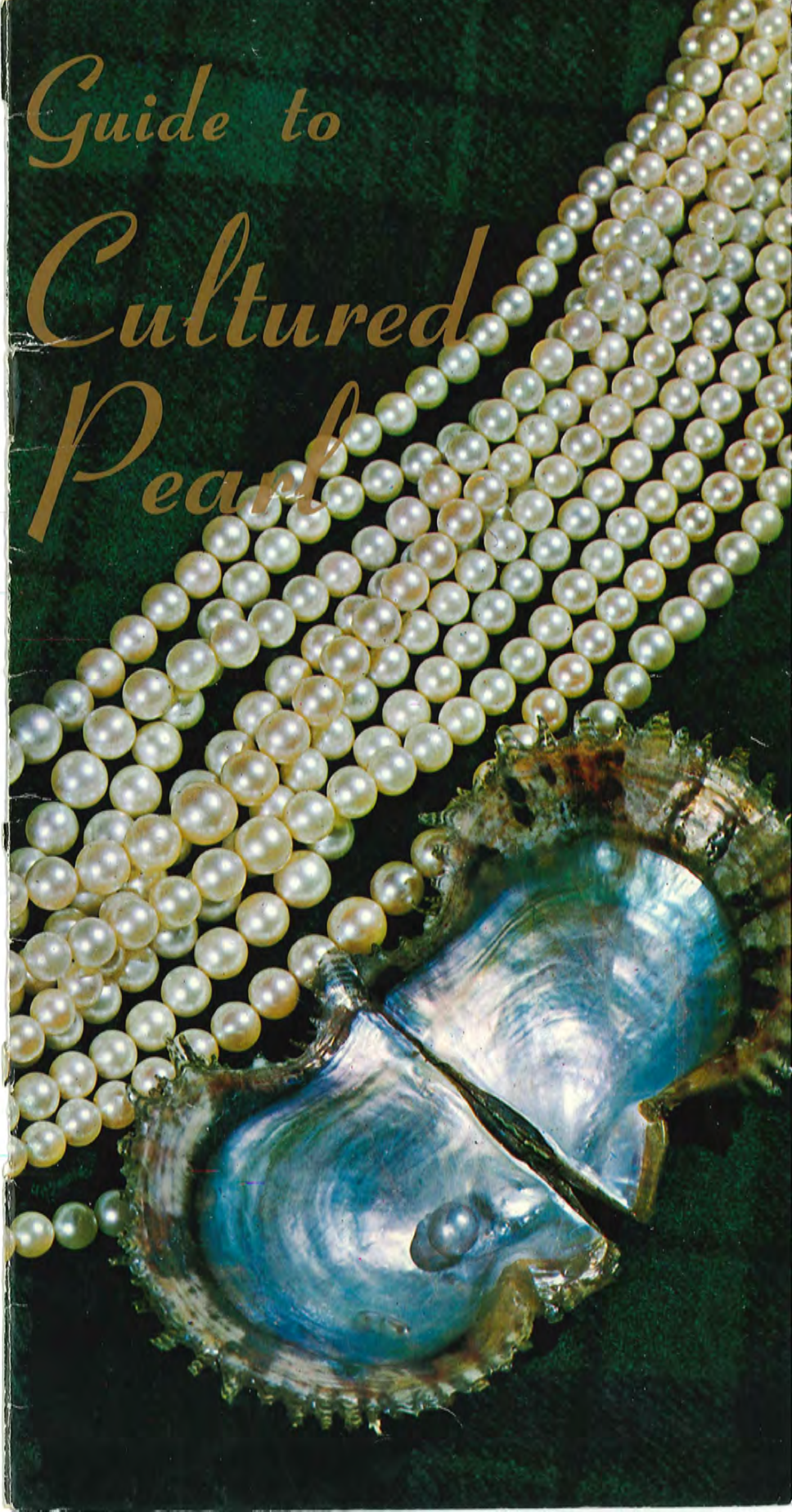
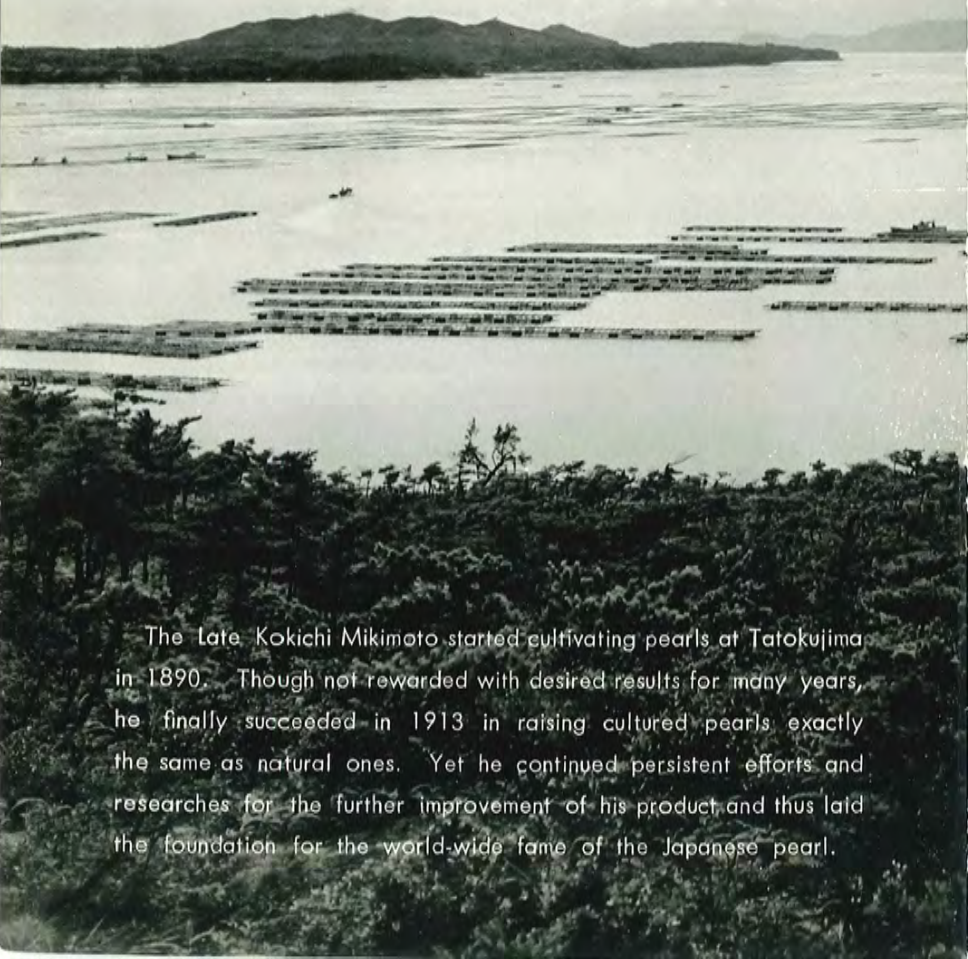
# Guide to Cultured Pearls



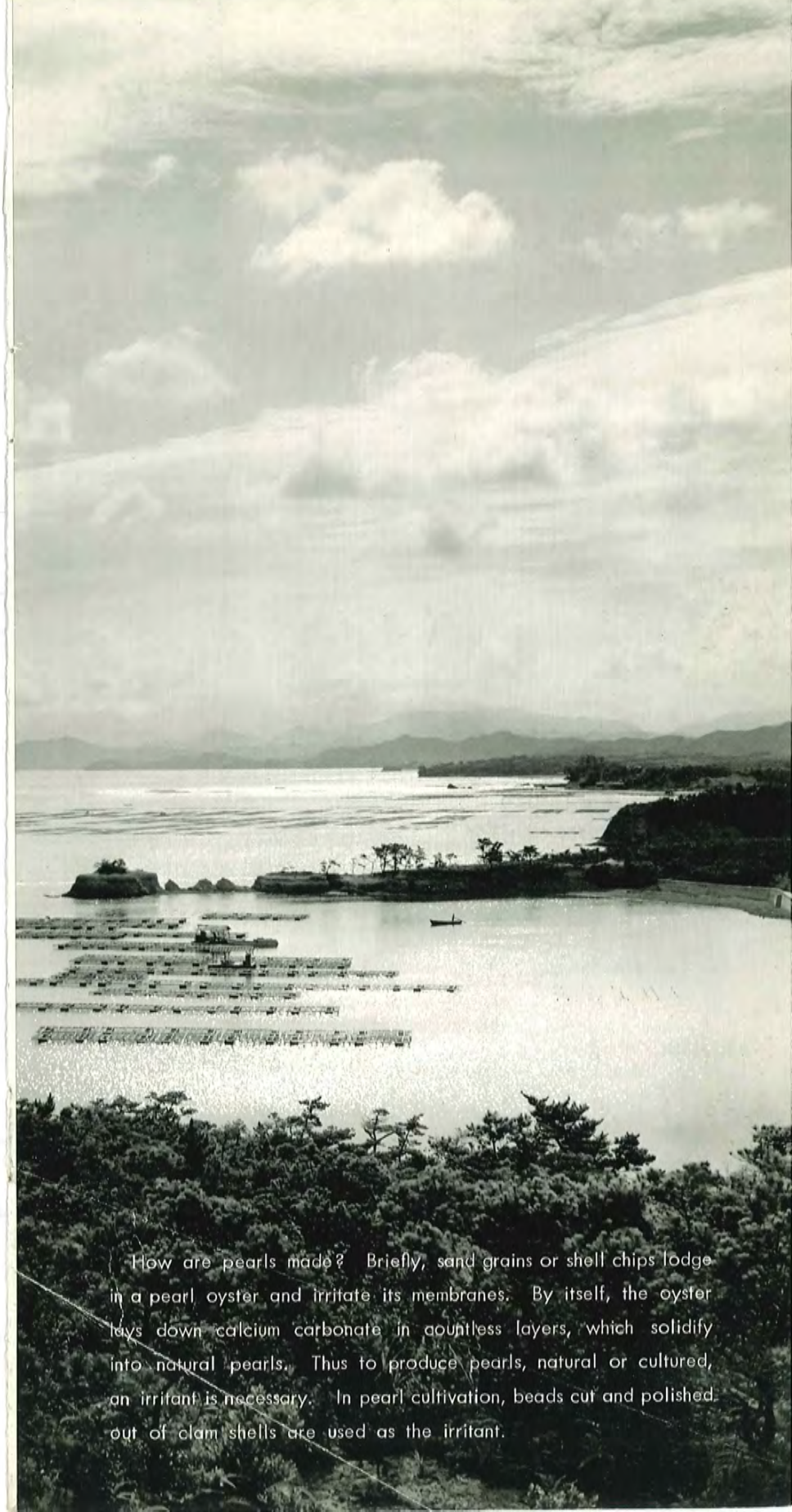
## Ise Shima National Park, the Center of Pearl Industry.

Ise Shima National Park was created on November 20th, 1946, including in its area, the city of Ise, a part of Watarai County, the city of Toba and the whole of Shima County, which occupies the southern half of Mie Prefecture, and offers many interesting attractions to the tourists, the chief among them being the Grand Shrines of Ise near Uji-Yamada and the pearl farms in Ago Bay.

Though not quite well known before, the mountains, seacoasts and many islands in this area have had a long history. And the scenic beauty, natural pearls and women divers were eulogized even by the poets of the Mannyoshu anthology, which was edited about one thousand years ago.



The Late Kokichi Mikimoto started cultivating pearls at Tatokujima in 1890. Though not rewarded with desired results for many years, he finally succeeded in 1913 in raising cultured pearls exactly the same as natural ones. Yet he continued persistent efforts and researches for the further improvement of his product and thus laid the foundation for the world-wide fame of the Japanese pearl.



How are pearls made? Briefly, sand grains or shell chips lodge in a pearl oyster and irritate its membranes. By itself, the oyster lays down calcium carbonate in countless layers, which solidify into natural pearls. Thus to produce pearls, natural or cultured, an irritant is necessary. In pearl cultivation, beads cut and polished out of clam shells are used as the irritant.

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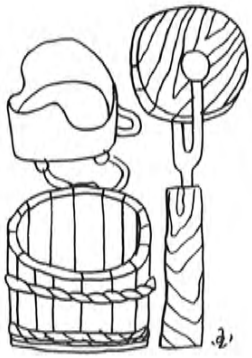
Ama collecting mother oysters

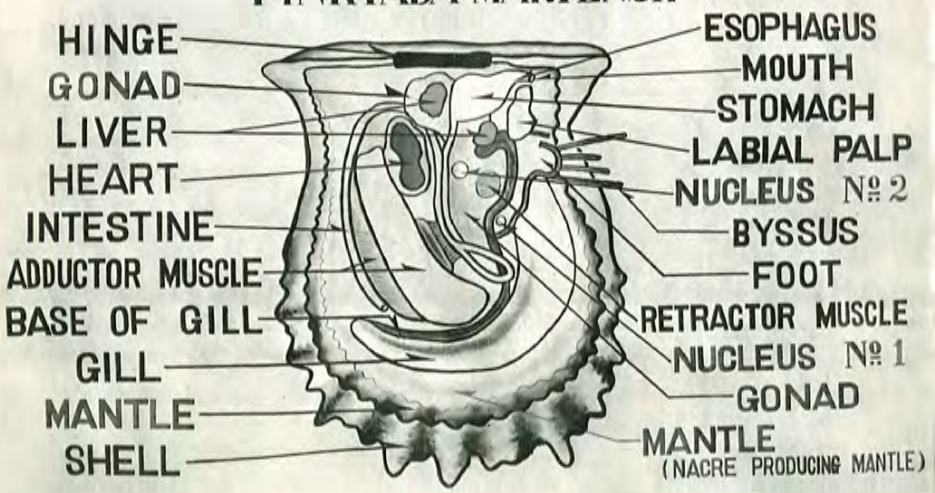
## Ama and Supply of Pearl Oysters for Operation.



In this area, rice paddies and vegetable fields are very scarce as compared with the average Japanese village, while shell-fishes and sea-weeds are found abundantly in the sea near by. So, naturally, women have to work in the sea as well. It is said that women are better fitted than men to dive deep under the sea.

These women divers are called 'ama', and are divided into two categories, "Kachido" and "Funado", "Kachido" means "walking diver" in Japanese. They are mostly young girls working in a group. "Funado" means "boat diver"

and works together with her husband in a couple. In July, they dive for collecting mother oysters which are used for operation in cultivating pearls. As the industry expanded, cultivators needed greater numbers of oysters, so that now efforts are being made to increase their production by artificial means. They suspend under water branches of cryptomeria or pine trees, which take hold of the eggs of oysters floating in the water. Lowered in July, these screens of branches are raised out of the water in November, with millions of tiny baby oysters sticking thereto. These are then transferred to protective cages to ensure their full growth.



Artificial means for collecting baby oysters

## Preparation of the Nucleus.

Although a pearl of sorts may be formed around almost any small object acting as nucleus, research and experience have proved that a calcareous nucleus has marked advantages over all other kinds. Japan, however, does not produce bivalves with shells thick enough to make nuclei of a sufficiently large diameter in such a quantity as to meet the demand. Before the war, oysters from the Yangtze River in China were imported and processed to make bead nuclei. After the war, as trade with China has been suspended, oysters from the Mississippi Valley are now being used.

To prepare the nuclei, these shells are cut into small cubes of various sizes required, which are then shaped into spheres, and polished up by machinery.

**Perfectly round nuclei are made from clam shells**

## The Secret of Pearl Oysters: the Mantle is the Very Source Creating the Pearl.

The anatomy of the oyster may be taken up in three main sections: the foot, the mantle and the visceral mass. Of these the mantle plays the most important part in the formation of pearls.

The mantle secretes the substances forming the calcareous shell. It also secretes crystalline calcium carbonate in the form of aragonite crystal, better known as nacre or mother of pearl.

If a small piece of mantle cut from an oyster is inserted into the connective tissue adjacent to the viscera of another oyster, the inner epithelium degenerates and disappears. The outer epithelium, however, will continue to grow and secrete calcareous material if transplantation has been made under favourable conditions. This characteristic quality of the outer epithelium is the basis of pearl formation—natural or cultured, and was discovered by a German biologist in 1913. He showed that pearls could be produced artificially by inserting the tegumental cells of the coating membrane, and that intruders from outside are not necessarily required for the formation of pearls, although they are helpful in the process. This theory generally came to be known as the "pearl bag theory."

## Preparations for Operation.

Before operating on the oysters for inserting nuclei, numerous host oysters must be procured to be ready for the technicians.

The oyster used in pearl cultivation is called the Akoyagai oyster (Pinctada Martensii), which grows naturally in the inlets of this area. It is quite different from edible oysters. The insertion of a bamboo or wooden plug between the open valves of the mollusc is the common practice among all operators, but how to induce the oyster to partially open its valves various with different stations. The methods used may be divided into three: Stagnant Water Method, Running Water Method and Dry Method. The Dry Method is widely used among the cultivators.

**Clearing eggs from host oysters**

**Inserting the wedge**

The host oysters are hauled up from nearby rafts and brought to the station wharf, where they are left hanging in baskets in the sea for about 24 hours before the operation. About half an hour before the technicians begin their work, the oysters are taken up on the wharf. Some 35% of them will soon be found beginning to open their valves. These are set apart for immediate operation, and the wedge is inserted between the valves. Those which do not open within a specific time are taken back under water for 4 more hours to get them recovered so as to be ready for pegging. Experience has shown that only the healthy and vigorous ones will open their valves when brought on land. The four hours rest in the sea will usually strengthen weakened oysters to open their valves and stand the operation of nucleus insertion.

## Preparation of Graft Tissue.

As the preparation and insertion of the graft tissue greatly affect the production of the pearl, grafting must be performed with the same strict care and precision that will be required in a delicate surgical operation.

The graft tissue is prepared from the frilled mantle edge of a living oyster, which is opened carefully by inserting a sharp knife between the valves. Then the adductor muscle is cut off from the shell. Care must be taken not to injure the mantle tissue in any way. A strip is cut off from the edge of the mantle, and this living tissue is smoothed out carefully on a wet trimming block, and the adhering slime or mucus is wiped off with a piece of viscose sponge.

The outer edge of the mantle, which secretes the substance forming the outer shell, is cut away with a sharp scalpel. The remaining tissue, as metioned earlier, produces nacre. It is trimmed to a long narrow strip, and cut traversely into tiny squares. This graft tissue will live for about two hours if kept wet with sea water, even in such tiny pieces.

**Operation stand**

Operation for inserting nuclei

## Insertion of the Nacre-producing Mantle and Nucleus.

When the partly open pegged oyster has been fixed in a desk cramp with the right valve uppermost, and the tissue grafts are ready, the operator smoothes out the mantle folds with a spatula, exposing the foot and the main body mass. A retractor hook is used to hold the foot down and extend it slightly to prevent its muscular action. Then an incision is made into the epithelium of the foot with a flat probe, and a slender channel is cut in the main mass of the tissue. Next, a piece of graft tissue is passed down the channel to the spot selected as the bed of the nucleus, which is picked up by the operator out of the moistened cup and inserted into the oyster to lie embedded immediately above the

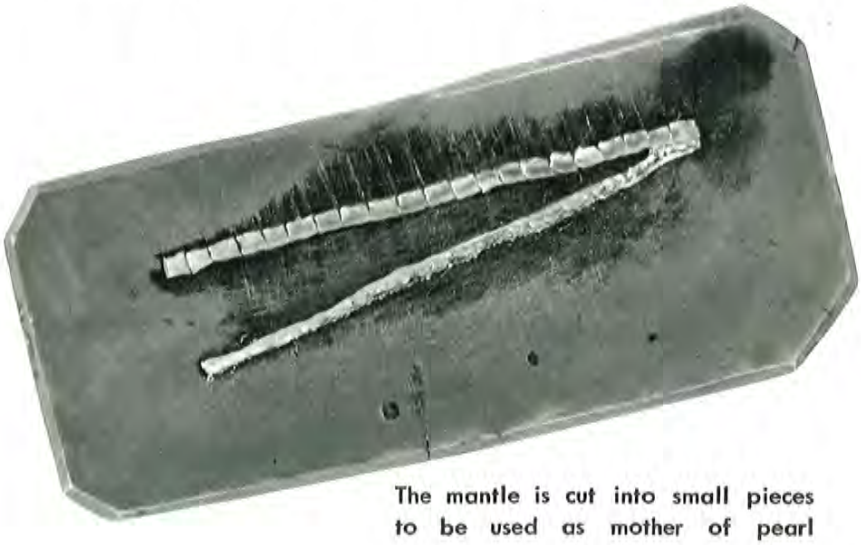
introduced graft tissue. The foot mass is smoothed gently with the back of the probe and the channel is closed over, the mucus helping to quicken the recovery. The foot is released from the retractor, and the peg removed from between the valves. The oyster closes immediately and is placed in a holding tray.

In order to produce the best pearls, the nacre-producing mantle cells must be kept in close contact with the nucleus in the body of the oyster. These inserted little square pieces of the mantle develop new cells, and keep growing until they cover up the whole surface of the nucleus, forming a pearl sack around it. Countless layers of mother-of-pearl are successively laid over the nucleus, such growth being estimated to be 0.5 micron per day.

According to the size of the oyster and of the irritant, from one to five nuclei are inserted in one oyster. A skilled technician can operate on 25 to 40 oysters per hour. The technique is difficult, and extreme delicacy of touch is necessary to perform this operation. Usually, village girls are employed in this work. They have to serve at least one year's apprenticeship to acquire sufficient skill to undertake the operation of nucleus insertion.

## Cultivating Rafts.

After the operation, the oyster is put into a wire cage with others similarly treated, some 20 to 40 per cage, which is suspended with many others from the logs of rafts anchored in sheltered waters near the pearl factory. The cages, submerged to a depth of two to three meters, remain undisturbed for four to six weeks, a period of recuperation, during which the oysters recover from the operational shocks and repair whatever injuries they may have sustained. After this period the cages are lifted and the oysters inspected; dead ones are removed, and the cages are then transferred by barges or motor boats to the permanent culture rafts.



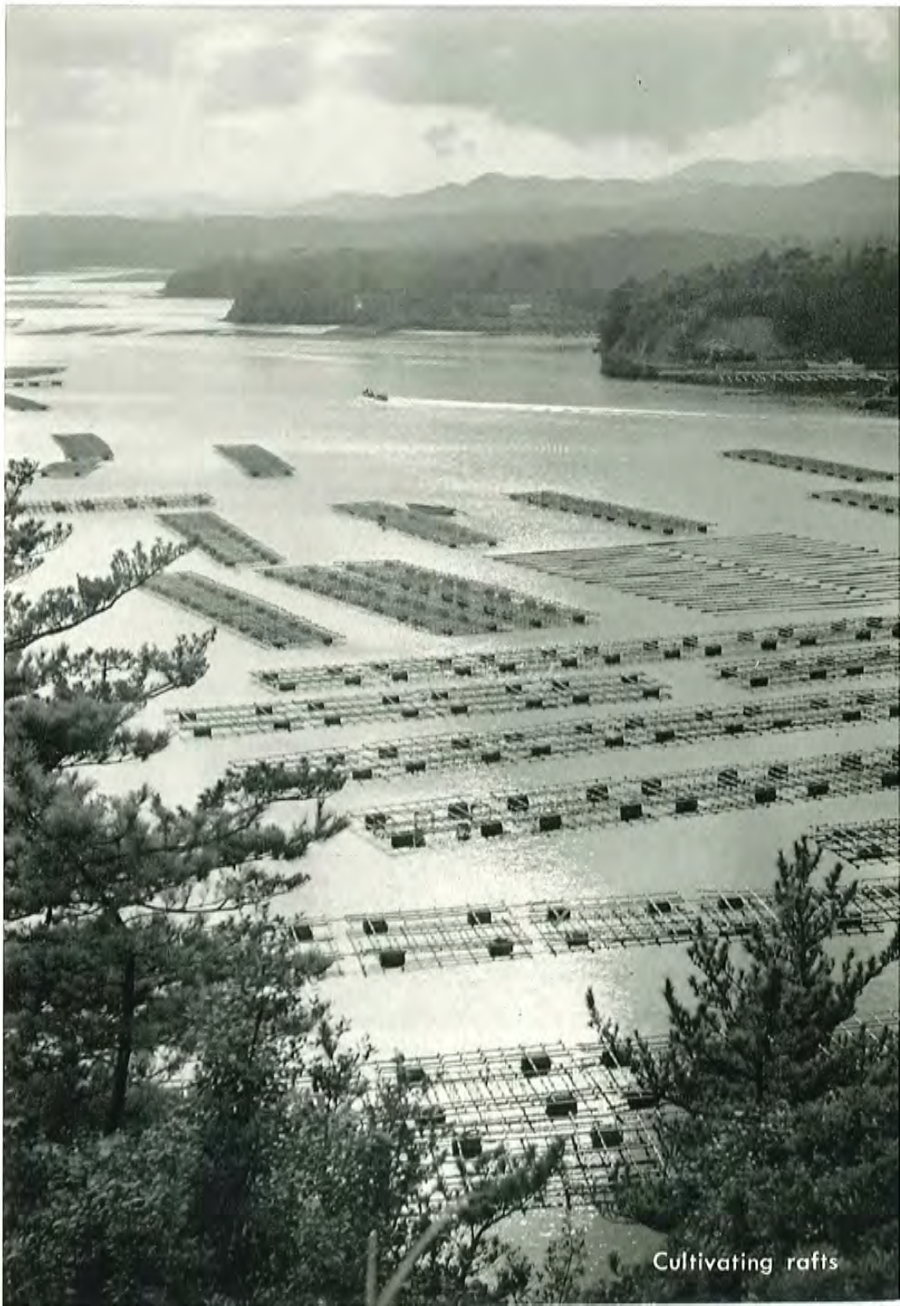
**The mantle is cut into small pieces to be used as mother of pearl**

**Oyster cultivating cages**

Each permanent raft supports 60 to 80 cages containing a total of 2,000 to 3,000 oysters. Such rafts may be seen floating in many groups on the quiet waters of the inlets, presenting a characteristic picture of the pearl farm. Here they remain, except for periodic cleaning, from one to five years. The oysters gradually grow, feeding on the planktons which are abundantly found in the sea about here.

Why are rafts used in cultivation? In the early days of pearl cultivation, oysters were reared in beds at the bottom of the sea. Mikimoto learned after years of experimentation, that his underwater culture yielded the best harvest, if gathered three years after operation but, if left underseas after the peak of brilliancy had been reached, the pearls were apt to lose their luster. Another serious problem was that the oysters were subject to constant menace from their vicious enemies, such as octopuses, eels and devilfish that often devoured entire beds, while barnacles and clinging seaweeds smothered thousands of oysters and prevented them from taking nourishments. If they were deposited in too great numbers within a restricted area, the supply of food would be insufficient, and many would die of malnutrition. Currents too cold or too warm might kill many of them. In this connection, an episode may be quoted: Once in January, Mikimoto had one million oysters laid in beds ten fathoms deep in the bay, when a

devastating red tide of planktons came sweeping in. He hired 200 women divers to save the oysters, but, as the water in mid-winter was too cold for the divers to work long under water, they could salvage only one-fourth of his oysters. No one can tell when the red tide might come in. To fight against such natural hazards, Mikimoto introduced wire cages and rafts, which gave protection against greedy fishes and treacherous seaweeds, as well as freer access to seawater food. Besides, the cages could be quickly hauled and carried to a safer place when a typhoon or red planktons threatened. Again, rafts of cages could easily be rowed off to some more temperate waters when unfavourable currents came along.



Cultivating rafts

Floating house used for cleaning oyster shells

At least three times a year, the cages are lifted up and all encrusting marine growths such as mosses, seaweeds and barnacles are removed, and a few living oysters are opened to ascertain the rate of growth of the pearls. The cleaned oysters are placed in freshly tarred cages, and the used cages are taken back to the shore base for renovating, cleaning and retarring.

During the long period of pearl growth, great pains have to be taken so that the oysters may not die from sudden changes in the conditions of the sea-water. Damaging factors are temperature, wind, rainfall and cold currents. For example, in the winter of 1925, hundreds of thousands of cultured oysters were killed in Ago Bay when the temperature of the water dropped to 9°c. The only possible protection against such conditions is, as is frequently done, to tow the rafts to some warmer bays near by. Not only is this done in case of emergency, but nowadays, cultivators in Ago Bay shift their oysters and rafts each winter from November to April to warmer sites washed by the Black Current, and thus prevent possible loss due to low water temperatures. Although Ago Bay is the greatest pearl center in Japan, no rafts are to be seen there during the winter period.

Fluctuations in surface and subsurface salinity may cause a serious loss to the culture crop. If a heavy downpour follows a prolonged wet spell, the surface run-off is extreme. The only solution to this problem is to tow the rafts away from the influence of the reduced salinity.

Pearl oysters before and after cleaning

Cleaning oyster shells

Observation post

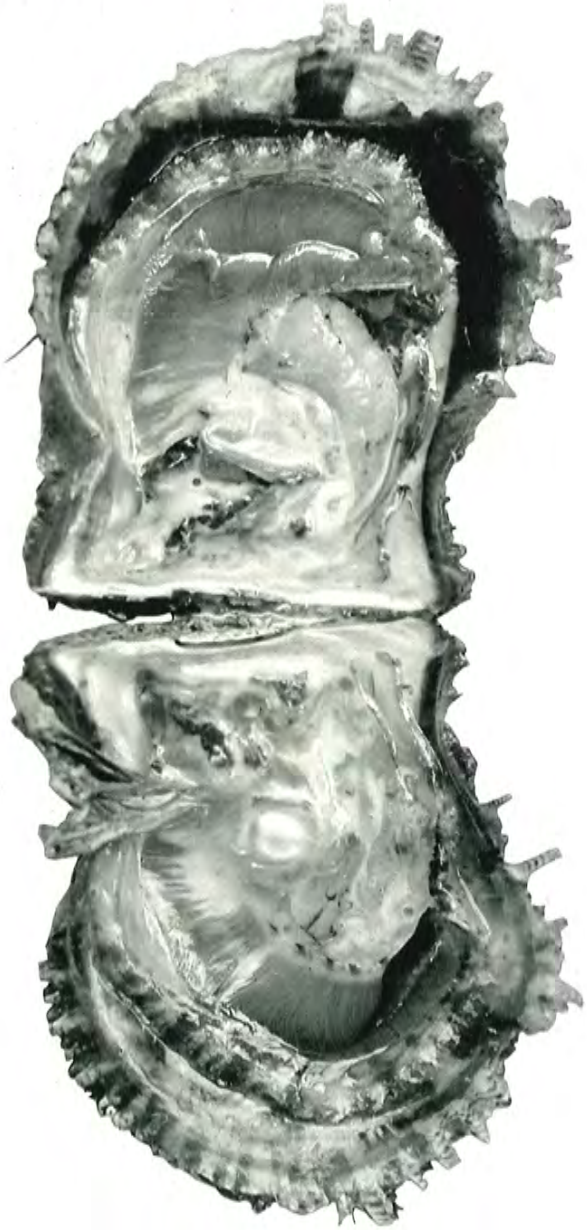
The greatest enemy of oysters is the red tide. This uninvited guest comes suddenly; it is so named because the sea turns red due to the multitude of microbes which propagate prolifically under favourable conditions. These microbes are especially harmful to fish and shellfish. In 1893 the red tide swept over the Mikimoto farm, and again in 1905, it destroyed the whole farm, killing 800,000 oysters which had been under cultivation in bamboo baskets at the bottom of the sea. The most recent red tide occurred on the 18th of August, 1948 in many smaller inlets of Ago Bay. The damage sustained can not be evaluated yet, but evidence from sampling indicates that it has been considerable.

Cleaning cages

Tarring oyster-cages

Oyster-cages and rafts shifted in winter to warmer sites

Harvesting pearls



Brilliant pearls are found imbedded in the Akoya-oyster

## Harvesting of Pearls.

After long years of vigilance as if for their own children, the cultivators take every possible care and pains for the nursing of the oysters until they are finally pulled up and taken out of the cages kept undersea, and then opened to yield up the long awaited gems.

Normal harvesting begins in November and continues until the middle part of January. It is believed that the oyster deposits thin and transculent layers only at the beginning of winter. This transculent layer deposited in the month just before harvesting adds materially to the quality of the pearl.

Long experience has shown that pearls of fine luster are generally harvested in winter. The luster—the sheen or gloss of the surface —is due to the fact that the surface of the pearl is composed of the ends of crystallized fibres. The reflection of light on this microscopically uneven surface apparently produces both luster and colour. The luster is produced by the interference of reflected light between a very thin and transparent organic layer and the crystalline grains beneath it. This scientific explanation confirms the cultivator's belief. Cultured pearls are commonly classified as silver, blue, pink, white, cream, yellow (or golden) and black.

In actual cases, however, the distinction of colours is not so definitely marked. In fact, the colour variations, apart from black and yellow, are so slight and subtle that they are distinguished only by experienced specialists. Yellow or golden pearls are quite distinct as are the so-called black pearls, which in reality are darkish bluegrey or gun-metal in shade.

Sorting pearls

Marking pearls for drilling

Colour varies according to the reflection and refraction of light on the crystalline structure of the pearl, but the causes of the structural variations are not known. In some cases of the yellow pearl, the presence of a pigment has been demonstrated. This pigment, which is localized in organic layers, has not yet been isolated or analyzed. The colour of the black pearl is apparently due to the presence of some organic matter between the pearl layers, but the identity of this substance is not as yet quite known, either.

Study of the possible relationship between the water depth and the colour of the pearl is still in its infancy, but it is presumed that shallow water tends to produce yellow pearls, and deep water, pink ones.

The relation between the position of the pearl in the body of the mother oyster and the resulting colour is also being studied. At present, the colour of pearls is still a secret of nature, over which the cultivator has little or no power of control. It can be said, however, that colour varies slightly from one producing district to another. Sometimes a pearl may be identified from its colour as coming from a particular area.

Pearls are gathered from mother oysters in due time, though actually about half of the nuclei inserted are harvested as grown-up pearls, and only 40% of them are found good for sale.

If you have an opportunity to watch cultivators harvesting their pearls, you will realize how few pearls are found perfect.

For each symmetrically spherical, large and evenly lustrous gem, there are a dozen peelers, slugs, monsters, turtlebacks, baroques and others of imperfect shapes and shades. Many must be discarded because they bear disfiguring flaws, being cracked, scratched, or marred by rings, indentations or too much showy reflections.

Generally speaking, about 40% of the total production have a market value, but fine-lustered and perfectly spherical pearls of

the highest grade number but 5%–10% in each season. Of these, large-sized pearls of the first grade, the most prized of all, usually amount to only three percent of the whole crop at any given time.

The medium-sized and small-sized pearls make the major portion of the total output. Under the present circumstances, small-sized pearl oysters predominate, and they are not fitted to raise large-sized pearls.

Usually it takes from 4 to 6 years to produce large-sized pearls. The infant oyster is nurtured in the sea, and after the irritant nucleus is inserted into it, three or four more years are required for the pearl to grow large enough in the mother oyster. Not more than half of the cultivators can afford to engage in this long term cultivation of large-sized pearls, so that most cultured pearls are of the medium or the small-size. The demand of the overseas market is usually for pearls of a very large size, but lack of capital prevents our cultivators from duly meeting this demand.

Of course, pearls of many different sizes are needed for necklaces. Pearls of medium and small sizes are comparatively inexpensive as they are abundantly produced, but the large center pearls are rare and therefore very expensive. Pearl necklaces are more expensive than foreign customers expect, and you will see the reason clearly if you visit a pearl farm where they are made. Operators are mostly young girls. They roll the pearls on black velvet to judge the shape and luster and inspect them on stark white cotton cloth under strong natural light to assort the colours. Size, shape, and shade must all be symmetrized on the string. Each pearl must be as evenly formed as if cut with a mechanical lathe. Each must be unblemished and glow with a definite tint, whether silver, white, pink, creamy or black. The entire strand must be so perfectly graduated in size that not another pearl could be inserted anywhere without spoiling the smooth flow from the largest to the smallest gem. It is such a delicate task

Drilling pearls for stringing

Stringing pearls

that only well trained and keen eyed girls with nimble fingers can do it. It is said that even an expert can assemble only half a dozen strands daily.

Before the war, Japanese cultured pearls were exported principally to European countries—England,, France, Italy, Switzerland, Spain, Denmark, Norway and Germany as well as to India. After the war, however, there has been little export to Europe, and the principal export has been to the United States.

Consequently, the demand has changed from the European taste for lustrous pearls to that for pink-white ones without blemish. Recently, however, inquiries have again started coming from Western Europe, where the demand is for pearls of fine luster even with a slight blemish, or for creamy pink pearls.

# History of Pearl Culture in Japan.

In 1893, Kokichi Mikimoto succeeded in cultivating hemi-spherical pearls, known as "shelled pearls", and thus the first page of the history of Japanese pearls was written. K. Mikimoto, the pearl king, was a son of a noodle shopkeeper, born in the port of Toba, Mie Prefecture. When he was 20 years old, he visited the Tokyo-Yokohama district, and in Yokohama he observed some Chinese merchants selling tiny pieces of pearls which were used for medicine. These pearls called "poppy seed pearls", he knew, were found in the Akoyagai oysters which grew in the inlets of Toba and Shima. As long as 2,000 years, they have been known to our poets as sparkling gems of the sea. This contact with poppy seed pearls determined the future of this ingenious youth. In 1890, he learned about the process of pearl formation from Dr. Minotsukuri, an authority on aquatic animals, and launched himself into his career as a pearl cultivator.

The LATE K. MIKIMOTO

This ambitious pioneer had endless difficulties to surmount in his initial attempt. He had made many painstaking efforts and experiments before he succeeded in 1893 in cultivating hemispherical pearls, which laid the ground-work of our pearl cultivation.

Tokichi Nishikawa of the Tokyo University devoted his life to the study of pearl cultivation, and in 1907 discovered that cells forming a pearl bag get into the system of a pearl oyster and secrets some fluid which forms a pearl. In 1909, he succeeded in the experimental production of spherical pearls, but unfortunately died in that year. His process was subsequently taken up and perfected by his two assistants, the Fujita brothers.

The main factory of Mikimoto pearl farm at Shintatoku

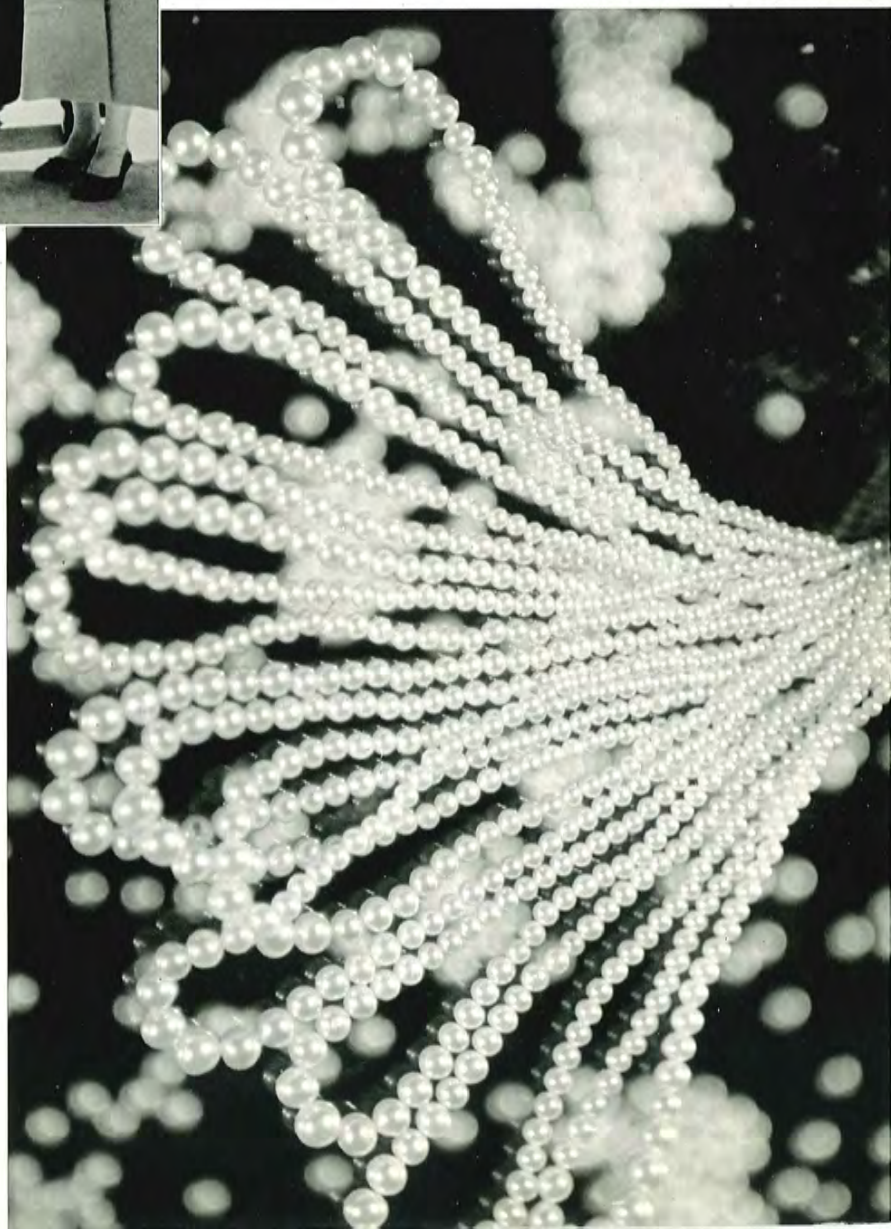
**The late Kokichi Mikimoto (Left) Greeting the Empress (right) at his pearl farm in Ago Bay.**

In 1928, this "Nishikawa" patent was handed over to general pearl cultivators, who made various successive improvements on the method initiated by Kitamura, Inoh, Otsuki and Isowa. The "Nishikawa" technique was a great step forward in pearl cultivation. It must be painted out here that the great success of Mikimoto has pushed the names of Nishikawa and Fujita into the back-ground, but that these members of his staff really did much to make the Mikimoto pearl technically what it is today.

Nevertheless, full credit is due to Mikimoto who devoted his whole life to the development of our pearl cultivation as an enterprise. Without him the Japanese pearl industry would not be holding the first place in the world to-day.

The National Pearl Research Institute was established at Kashikojima in 1956 for the purpose of promoting pearl culture enterprise. Besides this, there are at present, a number of research institutes which are engaged in the study of pearl cultivation. Among them noteworthy are the Kyoto University Pearl Research Institute, the

Brilliant luster of pearls



Mie University Fisheries Department, and the Mie Fisheries Experimental Station. Many large pearl farms also have their own laboratories.

Recently, the study of pearl cultivation through the use of isotopes is attracting considerable attention, and much is expected from the research along these lines.

To the readers:

This pamphlet is intended to give you correct information about pearls and pearl cultivation. We feel sure that by knowing more about the special attraction of this place, the more you will enjoy your stay here, and we hope you will take back to your folks at home a souvenir, not only of the brilliant gems, but also an inspiring realization how the ingenuity of man can improve and magnify the gift of Nature.

Published by ..... SHIMA KANKO HOTEL

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## Shima Kanko Hotel

A Floating Palace on the Sea of Pearls in the center of Ise-Shima National Park.

Premier Hotel de luxe in the heart of peerless scenic beauty, Shima Kanko Hotel, offers you....rest....privacy....good food....modern western accommodations....homelike service.

## Accommodation

| **ROOM RATE** | | for one | for two |
|---|---|---|---|
| Single Bed Room w/bath (With Sofa) | | ¥2,400 | ¥3,100 |
| Twin Bed Room w/bath | | ¥2,000—¥3,300 | ¥3,000—¥4,300 |
| Suite Room | | ¥3,800 or ¥5,800 | ¥5,000 or ¥8,000 |
| Japanese Style without bath | | ¥1,200—¥1,300 | ¥1,700—¥1,800 |
| Japanese Style w/bath | | ¥2,800—¥3,600 | ¥3,800—¥4,600 |
| **MEAL CHARGE** | | | hour |
| Table d'hote | | | |
| Breakfast | ¥450 | | 7:00—11:00 |
| Luncheon | ¥600 | ¥800 | 11:30—14:00 |
| Dinner | ¥1,200 | ¥1,600 | 18:30—20:30 |
| **GRILL "LANGOUSTE"** | | | 11:00—22:00 |

Special Sea-Food a la prunier and also a la carte

**BAR "LA MER"** 13:00—23:00

**SUSHI "HAMAYU"** 18:00—23:00

**SUKIYAKI ROOM** 18:00—23:00

The well-known Matsuzaka-beef will give you full enjoyment of its extra delicious taste in the traditional Japanese-style 'TATAMI' matted rooms.

**TEA ROOM**

Traditional Tea-Ceremony can be arranged in Japanese tea room upon request.

**SOUVENIR SHOP** 8:00—22:00

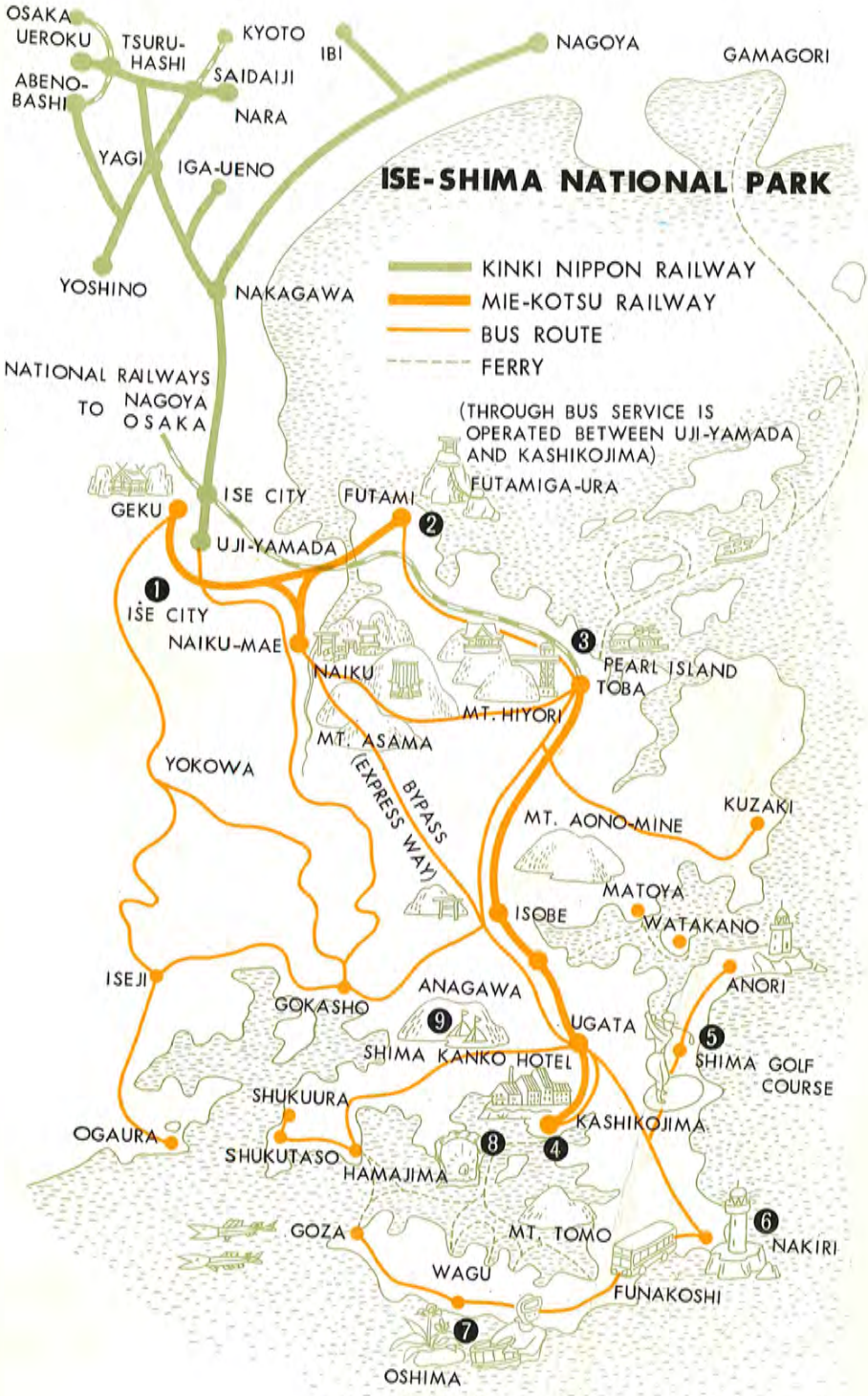
**COFFEE SHOP** 10:00—22:00

**SWIMMING POOL** (Open....July, August.) 9:00—21.00

## PLACES OF INTEREST

The numbers on the map are for your reference in locating places worth visiting in this Park.

1. **Ise City**·····Site of the Grand Shrines of Isé.
2. **Futami**·····Noted for its sunrise view as seen from between the "Man and Wife" rocks.
3. **Toba**·····A port-town foremost in Shima Province, with "Pearl Isle" right in front, where the whole process of pearl cultivation may be observed on the spot. The terminal station of Japanese National Railways.
4. **Kashikojima**·····The terminal of the Shima Electric Railway and the starting point of the coastal shipping service in Ago Bay. The Shima Kanko Hotel and the National Pearl Research Laboratory are located here.
5. **Ko**·····The extensive Shima Golf Course has been newly completed. This area also abounds in scenic spots.
6. **Nakiri**·····Widely known to artists for the picturesque view of Cape Daio surmounted by a lighthouse.
7. **Waga**·····A fishing village noted for women divers and the natural growth of the "hamayu", a plant of the tropical orchid family. It is registered as a "Natural Monument."
8. **Shin-Tatoku Island**·····The center of the Mikimoto Pearl farming of world-wide renown.
9. **Yokoyama Hill**·····A scenic spot commanding a panoramic view of Ago Bay.


OSAKA
UEROKU
TSURU-HASHI
KYOTO
IBI
NAGOYA
GAMAGORI
ABENO-BASHI
SAIDAIJI
NARA
YAGI
IGA-UENO
ISE-SHIMA NATIONAL PARK
KINKI NIPPON RAILWAY
MIE-KOTSU RAILWAY
BUS ROUTE
FERRY
YOSHINO
NAKAGAWA
NATIONAL RAILWAYS
TO NAGOYA
OSAKA
(THROUGH BUS SERVICE IS OPERATED BETWEEN UJI-YAMADA AND KASHIKOJIMA)
FUTAMIGA-URA
ISE CITY
FUTAMI
GEKU
UJI-YAMADA
ISE CITY
NAIKU-MAE
NAIKU
PEARL ISLAND
TOBA
MT. HIYORI
MT. ASAMA
YOKOWA
BYPASS (EXPRESS WAY)
MT. AONO-MINE
KUZAKI
MATOYA
ISOBE
WATAKANO
ISEJI
GOKASHO
ANAGAWA
ANORI
UGATA
SHIMA KANKO HOTEL
SHIMA GOLF COURSE
SHUKUURA
KASHIKOJIMA
OGAURA
SHUKUTASO
HAMAJIMA
GOZA
MT. TOMO
NAKIRI
WAGU
FUNAKOSHI
OSHIMA

# Shima Kanko Hotel